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PATENT
Customer No. 22,852
Attorney Docket No. 08350.1644-02000

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of:	
Gerrick S. GEHNER et al.	Group Art Unit: 2856
Application No.: 10/702,444	Examiner: Robert R. Raevis
Filed: November 7, 2003	
For: METHOD AND APPARATUS FOR MIXING GASES	Confirmation No.: 9713

Mail Stop Appeal Brief--Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

TRANSMITTAL OF APPEAL BRIEF (37 C.F.R. 41.37)

Transmitted herewith is the APPEAL BRIEF in this application with respect to the Notice of Appeal filed on June 15, 2005.

This application is on behalf of

☐ Small Entity ☒ Large Entity

Pursuant to 37 C.F.R. 41.20(b)(2), the fee for filing the Appeal Brief is:

☐ $250.00 (Small Entity)

☒ $500.00 (Large Entity)

TOTAL FEE DUE:

Notice of Appeal Fee	$500.00
Extension Fee (if any)	$120.00
Total Fee Due	$620.00

☒ Two checks are enclosed totaling $620.00 to cover the above fees.

PETITION FOR EXTENSION. If any extension of time is necessary for the filing of this Appeal Brief, and such extension has not otherwise been requested, such an extension is hereby requested, and the Commissioner is authorized to charge necessary fees for such an extension to our Deposit Account No. 06-0916. A duplicate copy of this paper is enclosed for use in charging the deposit account.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

Dated: September 15, 2005

By: ____________________
Roland G. McAndrews
Reg. No. 41,450

PATENT
Customer No. 22,852
Application No. 10/702,444
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
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Attention: Mail Stop Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

APPEAL BRIEF UNDER BOARD RULE § 41.37

In support of the Notice of Appeal filed June 15, 2005, and further to Board Rule 41.37, Appellants present this brief and enclose herewith a check for the fee of $500.00 required under 37 C.F.R. § 1.17(c).

This Appeal is in response to the final rejection of claims 1-6, 8-15, 17, and 22-35 in the Office Action mailed on February 16, 2005.

If any additional fees are required or if the enclosed payment is insufficient, Appellants request that the required fees be charged to Deposit Account No. 06-0916.

Table of Contents

Real Party In Interest

Caterpillar Inc. is the real party in interest.

Related Appeals and Interferences

There are currently no other appeals or interferences, of which Appellants, Appellants' legal representative, or Assignee are aware, that will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

Status Of Claims

Claims 1-6, 8-15, 17, and 22-35 were rejected; claim 16 was objected to, and claims 7 and 18-21 have been canceled. Claims 1-6, 8-15, 17, and 22-35 are involved in this appeal. A copy of these claims is provided in the attached appendix to the appeal brief.

Status Of Amendments

An Amendment after final was filed subsequent to the final rejection of claims 1-6, 8-15, 17, and 22-35 in the final Office Action mailed on February 16, 2005. The Amendment after final was denied entry in the Advisory Action mailed on May 27, 2005.

Summary Of Claimed Subject Matter

The invention relates to a method and apparatus for mixing a first stream of gas with a second stream of gas prior to sampling a combined stream of the gases.

The apparatus includes a first plurality of passages configured to direct the first stream of gas, wherein the first stream of gas is one of a stream of dilution air and a stream of exhaust gas from an engine. See specification at page 5, paragraph no. 18, lines 4-6, and FIG. 1; and specification at page 4, paragraph no. 16, lines 3-5, and FIG. 1. The apparatus also includes a mixing chamber having first and second ends. See specification at page 6, paragraph no. 20, lines 2-3, and FIG. 2. The mixing chamber is flow coupled to the first plurality of passages and configured to receive the second stream of gas at the first end. See specification at page 6, paragraph no. 20, lines 3-4, and FIGS. 1 and 2. The mixing chamber has an exit port at the second end. See specification at page 7, paragraph 23, line 3, and FIG. 2. The second stream of gas is the other of the stream of dilution air and the stream of exhaust gas from an engine. See specification at page 4, paragraph no. 16, lines 4-5, and FIG. 1.

The mixing chamber includes an internal volume defined by the first end, the second end, and walls extending between the first and second ends. See specification at page 6, paragraph 20, lines 2-3, and FIG. 2. The second end has a gradually converging portion. See specification at page 7, paragraph 24, lines 1-2, and FIG. 2. The mixing chamber also includes a first inlet opening configured to receive the first stream of gas, and a plurality of second inlet openings configured to receive the second stream of gas, with the plurality of second inlet openings symmetrically positioned with

respect to the first inlet opening. See specification at page 7, paragraph 21, lines 1-5, and FIGS. 2 and 3. The mixing chamber further includes the exit opening configured to discharge the combined stream of gas, with the exit opening located downstream of the gradually converging neck portion. See specification at page 7, paragraph 23, lines 3-4, and FIGS. 2 and 3.

The method includes introducing the first stream of gas into the mixing chamber via the plurality of first stream passages flow coupled to the mixing chamber. See specification at page 5, paragraph no. 18, lines 4-6, and FIG. 1. The method also includes directing the second stream of gas into the mixing chamber via at least one second stream passage flow coupled to the first end of the mixing chamber. See specification at page 6, paragraph no. 19, lines 1-2, and FIG. 1. The method further includes forming a combined stream from the first and second streams and discharging the combined stream from the mixing chamber through the mixing chamber exit port. See specification at page 7, paragraph no. 23, lines 1-4, and FIG. 1.

Grounds of Rejection

A. Claims 1, 2, 4-5, 8-10, 12-14, 17, and 22-35 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,604,319 to Kohsaka et al. ("Kohsaka") in view of U.S. Patent No. 3,913,617 to van Laar et al ("van Laar").

B. Claims 3, 6, 15, and 32-35 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kohsaka in view of van Laar, and further in view of U.S. Patent No. 5,090,258 to Yamasaki et al ("Yamasaki").

C. Claim 11 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Kohsaka in view of van Laar, and further in view of U.S. Patent No. 6,293,161 to Hanashiro et al. ("Hanashiro"), and further in view of U.S. Patent No. 6,114,178 to Dezael et al. ("Dezael").

D. Claim 16 stands objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Arguments

A. The Rejection of Claims 1, 2, 4-5, 8-10, 12-14, 17, and 22-35 Under 35 U.S.C. § 103(a) as Being Unpatentable Over Kohsaka In View of van Laar Should be Withdrawn

The Examiner rejected claims 1, 2, 4-5, 8-10, 12-14, 17, and 22-35 under 35 U.S.C. § 103(a) as being unpatentable over Kohsaka in view of van Laar. The Board should reverse the rejection because the Examiner has failed to establish the required *prima facie* case of obviousness. To establish a *prima facie* case of obviousness, there must be some suggestion or motivation to modify the reference or to combine reference teachings. The teaching or suggestion to make the claimed combination must be found in the prior art, and must not be based on Applicants' disclosure. *In re Vaeck*, 947 F.2d 488 (Fed. Cir. 1991). See MPEP § 2143.

Kohsaka discloses that exhaust gas from an engine 1 is introduced into a dilution tunnel 3 via an exhaust pipe 2. See FIG. 1. Kohsaka also discloses that air is drawn into the dilution tunnel 3 through an air filter 4, and the diluted exhaust gas is then drawn through a venturi tube 6. See FIG. 1.

van Laar discloses a system for cooling a hot-blast flow with a cold air flow having a greatly different temperature, for a blast furnace. A first conduit 1 carries the hot-blast flow and a second conduit 2 carries the cold air flow. A ring main 3 and a plurality of pipe bends 4 connect the second conduit 2 to the first conduit 1. See van Laar, column 2, lines 62-column 3, line 4. In order to introduce the cold air flow into the hot-blast flow, the cross-section of all of the pipe bends amounts to a maximum of 15% of the flow cross-section of the first conduit. Thus, the cold air is introduced into the first

conduit, at a high velocity, perpendicular to the hot-blast flow, forcing the cold air deep into the hot-blast flow. See van Laar, column 2, lines 20-28 and 55-57. Furthermore, in order to increase the velocity of the cold air flow, it is possible to reduce the flow cross-section of the pipe bends, or discharge openings may be reduced. See van Laar, column 3, lines 31-36.

1. The Cited Prior Art Does Not Teach, Suggest, or Provide Motivation to Modify the Reference or to Combine Reference Teachings

The Office Action mailed on February 16, 2005, suggests combining Kohsaka with van Laar by modifying an exhaust pipe 2 of an engine 1 of an automobile in Kohsaka to include the ring main 3 and pipe bends 4 of van Laar, and also to terminate the modified exhaust pipe of Kohsaka at the wall of its dilution tunnel 3. However, Appellants respectfully submit that such a combination does not establish a *prima facie* case of obviousness because there is no teaching or suggestion in the art to modify Kohsaka with van Laar in the manner suggested.

Kohsaka discloses that exhaust pipe 2 is associated with the engine 1 of an automobile. See Kohsaka, column 2, lines 47-52. Replacing the exhaust pipe 2 of Kohsaka with the ring main and pipe bends of van Laar would require modifying that part of the engine of the automobile in Kohsaka to have a highly irregular shape. One skilled in the art would not be motivated to redesign the exhaust pipe 2 of the engine of the automobile to have the shape taught by van Laar at least due to the increases in the amount of material used to create the exhaust pipe 2 and the manufacturing costs associated with producing a ring-shaped exhaust pipe for an engine of an automobile.

Furthermore, van Laar discloses that using the ring main and pipe bends creates a danger in that the hot-blast enters the pipe bends and the ring mains. See Van Laar, column 2, lines 35-37. Accordingly, modifying the exhaust pipe 2 of Kohsaka to have the ring mains and pipe bends of van Laar would present a danger of the air flow of Kohsaka entering the exhaust pipe 2, which could skew the test results obtained from the emissions sampling device of Kohsaka. FIG. 1 of Kohsaka actually teaches away from arranging the exhaust pipe 2 in a manner allowing air to flow therein, as evidenced by the outlet of exhaust pipe 2 facing away from the direction of air flow, thus preventing air from flowing into the exhaust pipe 2.

Additionally, as Appellants set forth in their Reply to Office Action filed on January 25, 2005, neither Kohsaka nor van Laar provides any suggestion or motivation to add the ring main and pipe bends of van Laar to the sides of the dilution tunnel of Kohsaka in order to introduce its exhaust stream at its wall. For the reasons described in the prior Reply to Office Action, van Laar teaches that when its cold air conduits terminate at the walls of the hot-blast flow conduit, the cold air is introduced at a high velocity to achieve proper mixing. On the other hand, Kohsaka would suggest that proper mixing is achieved by introducing the exhaust gas into the middle of its dilution tunnel, rather than at the sides of its dilution tunnel. These teachings together do not provide a suggestion or motivation to one skilled in the art to combine the teachings in a manner that renders the claims unpatentable, because to replace the exhaust pipe of Kohsaka with the cold air conduits of van Laar would cause the exhaust in Kohsaka to be introduced into the dilution tunnel 3 through pipe bends at a relatively high velocity to

achieve proper mixing. Introducing the exhaust gas at a high velocity in Kohsaka is unacceptable because it would increase the backpressure in the exhaust pipe, thereby affecting the emissions from the associated engine and skewing any results obtained from the emissions sampling device of Kohsaka. If combined as proposed, the emission sampling system of Kohsaka would become inoperable for its intended purpose because any test results would be skewed. Therefore, neither of these references provides a suggestion or motivation to combine and modify them in a manner that would render the claims unpatentable.

The Office Action mailed on February 16, 2005 states that the above arguments were previously recognized, but that the Office Action is relying upon van Laar "expressly . . . for a very homogeneous mixture." See Office Action, page 6. However, it is well established that any prior art reference must be considered in its entirety. See MPEP § 2143.02. Accordingly, any disclosure van Laar that leads or teaches away from the claimed invention must also be considered, including the disclosure in van Laar of pressurizing what is allegedly the equivalent of the exhaust gas in Kohsaka to achieve high velocities. Considering van Laar in its entirety requires consideration of reasons that one skilled in the art would be motivated to *not combine* the teachings of van Laar with the teachings of Kohsaka. For the reasons set forth above, one skilled in the art would not be motivated to combine the teachings of Kohsaka and van Laar because van Laar teaches that to obtain good mixing, the air must blow at high velocities. This would cause backpressure in the exhaust pipe of Kohsaka and skew any sampling results taken with the system of Kohsaka. Because the system of

Kohsaka would effectively become inoperable for its intended use, there is no suggestion or motivation to combine Kohsaka with van Laar.

For all of the above reasons, Appellants request that the rejection against independent claims 1, 9, 22, 30, 31, 32, and 34 be reversed, along with claims 2-6, 8-17, and 22-35 that depend either directly or indirectly from claims 1, 9, 22, 30, 31, 32, and 34.

2. The Cited Prior Art Does Not Disclose or Suggest the First Inlet Opening and the Plurality of Second Inlet Openings Being Situated in a Manner that the First and Second Streams of Gas Avoid Impinging On Each Other As They Enter the Mixing Chamber

With respect to dependent claims 25-27, Appellants submit that the cited prior art does not disclose or suggest the first inlet opening and the plurality of second inlet openings being situated in a manner that the first and second streams of gas avoid impinging on each other as they enter the mixing chamber, as required by these claims. As explained in the Reply to Office Action filed on January 25, 2005, avoiding impinging is meant to describe the situation where the gas flows are introduced into the mixing chamber in a direction where the gas stream of one gas does not directly cross the gas stream of the other gas. Such a system is disclosed in FIGS. 2 and 3 of the present application, where the gas streams of each flow are introduced into the mixing chamber in the same direction. The gas streams do not cross each other, and therefore, they avoid impinging on each other as they enter the mixing chamber. Even if Kohsaka and van Laar were properly combinable, and Appellants do not believe they are, the features of claims 25-27 would not be taught or suggested because van Laar discloses

that the gas stream entering the pipe bends 4 enter perpendicularly into the gas stream passing through the first conduit 1. Accordingly, the gas streams would be impinging.

For the above reason, Appellants request that the rejection against claims 25-27 be reversed

B. The Rejection of Claims 3, 6, 15, and 32-35 Under 35 U.S.C. § 103(a) as Being Unpatentable Over Kohsaka In View of van Laar, and Further In View of Yamasaki

The Examiner rejected claims 3, 6, 15, and 32-35 under 35 U.S.C. § 103(a) as being unpatentable over Kohsaka in view of van Laar, and further in view of Yamasaki. The Board should reverse the rejection because the Examiner has failed to establish the required *prima facie* case of obviousness. Claims 3, 6, 15, 33 and 35 depend either directly or indirectly from independent claims 1, 9, 32, and 34. As discussed above with regard to independent claims 1, 9, 32, and 34, the combination of Kohsaka and van Laar fails to establish the required *prima facie* case of obviousness. Yamasaki does not remedy the deficiencies of Kohsaka and van Laar. For at least this reason, neither Kohsaka, van Laar, or Yamasaki, taken either alone or in combination, renders claims 3, 6, 15, and 32-35 unpatentable.

1. The Cited Prior Art Does Not Teach, Suggest, or Provide Motivation to Modify the Reference or to Combine Reference Teachings

Combining Kohsaka and Yamasaki by adding a flow-rectifying plate 13 of Yamasaki to the dilution tunnel 3 of Kohsaka between the filter 4 and exhaust inlet 2, also fails to establish a *prima facie* case of obviousness because there is no teaching or suggestion in the art to modify Kohsaka with Yamasaki in the manner suggested. The

Office Action mailed on February 16, 2005, relies upon Yamasaki for the teaching of a flow rectifying plate, stating that such a plate effectively transmits dilution air into a mixer and also results in a well-developed flow of the dilution gas. See Office Action, page 4. The Office Action also states that the "plate straightens flow of dilution air passing there through, and results in a well developed gas stream . . . ." See Office Action, page 6. Appellants respectfully submit that the flow rectifying plate taught in Yamasaki does not provide a well-developed flow stream, as recited in claims 32 and 34. The rectifying plate in Yamasaki is a thin plate that appears to have at least one passage there through. The passage size appears to have a width greater than its length. As described in the Specification, a well-developed flow may arise in a long pipe if the flow is not subject to any protrusions, changes in cross-section, or other disturbances. See specification at page 5, paragraph 18, lines 6-15. In Yamasaki, any passage through the flow rectifying plate, having a width greater than its length, is not a long pipe, as described. Therefore, the flow-rectifying plate 13 does not develop a well-developed flow, but rather, seems to act as a protrusion or other disturbance that prevents a well-developed flow from developing.

For all of the above reasons, Appellants request that the rejection against dependent claims 3, 6, and 15, and independent claims 32 and 34 be reversed, along with claims 33 and 35 that depend directly from claims 32 and 34.

C. The Rejection of Claim 11 under 35 U.S.C. § 103(a) as being unpatentable over Kohsaka in view of van Laar, and further in view of Hanashiro, and further in view of Dezael

The Examiner rejected claim 11 under 35 U.S.C. § 103(a) as being unpatentable over Kohsaka in view of van Laar, and further in view of Hanashiro and Dezael. The Board should reverse the rejection because the Examiner has failed to establish the required prima facie case of obviousness. Claim 11 depends indirectly from independent claim 9. As discussed above with regard to claim 9, the combination of Kohsaka and van Laar fails to establish the required prima facie case of obviousness. Neither Hanashiro nor Dezael remedies the deficiencies of Kohsaka and van Laar. For at least this reason, neither Kohsaka, van Laar, Hanashiro, or Dezael, taken either alone or in combination, renders claim 11 unpatentable.

1. The Cited Prior Art Does Not Teach, Suggest, or Provide Motivation to Modify the Reference or to Combine Reference Teachings

Combining Kohsaka and Dezael also fails to establish a *prima facie* case of obviousness because Kohsaka and Dezael, whether taken alone or in combination, fails to teach or suggest all the claim limitations recited in claim 11. The Office Action mailed on February 16, 2005, relies upon Dezael as a teaching of insulation 17. See Office Action, page 4. However, Appellants respectfully submit that Dezael fails to teach or suggest, "wherein at least the second stream passage, the mixing chamber, and the secondary mixing region are insulated," as recited by claim 11. Rather, Dezael teaches or suggests providing insulation 17 and 22 around a cavity 4, heating resistor 16, and connection (tip and pipe) of a syringe. See Dezael, column 3, lines 63-67; column 4,

lines 40-47. Because the cavity, heating resistor, and connection of Dezael are not a second stream passage, mixing chamber, and secondary mixing region, then Dezeal fails to teach or suggest the second stream passage, mixing chamber, and secondary mixing region being insulated, as recited in claim 11. Accordingly, for all of the above reasons, Appellants request that the rejection against dependent claim 11 be reversed.

Conclusion

For the reasons given above, pending claims 1-6, 8-17 and 22-35 are allowable and reversal of the Examiner's rejection is respectfully requested.

To the extent any extension of time under 37 C.F.R. § 1.136 is required to obtain entry of this Appeal Brief, such extension is hereby respectfully requested. If there are any fees due under 37 C.F.R. §§ 1.16 or 1.17 which are not enclosed herewith, including any fees required for an extension of time under 37 C.F.R. § 1.136, please charge such fees to our Deposit Account No. 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

Dated: September 15, 2005

By: ______________________
Roland G. McAndrews
Reg. No. 41,450

Claims Appendix to Appeal Brief Under Rule 41.37(c)(1)(viii)

A listing of the claims on appeal is required. This should be a clean copy of all pending claims on appeal.

1. (Previously presented) A method of mixing a first stream of gas with a second stream of gas, comprising:

introducing a first stream of gas into a mixing chamber via a plurality of first stream passages flow coupled to the mixing chamber, wherein the first stream of gas is one of a stream of dilution air and a stream of exhaust gas from an engine;

directing a second stream of gas into the mixing chamber via at least one second stream passage flow coupled to a first end of the mixing chamber, the second stream of gas is the other of the stream of dilution air and the stream of exhaust gas from an engine;

forming a combined stream from the first and second streams; and

discharging the combined stream from the mixing chamber through a mixing chamber exit port,

the method further including at least one of the following characteristic factors:

1) directing the first and second streams of gas through the plurality of first stream passages and the second stream passages into the mixing chamber in a manner that the streams of gas are unobstructed by structure as they enter the mixing chamber;

2) providing walls of the mixing chamber with an absence of structure extending into the mixing chamber;

3) introducing the first and second streams of gas from the plurality of first stream passages and the second stream passage into the mixing chamber with a substantially well-developed flow; and

4) introducing at least one of the first and second streams of gas, as the exhaust gas, into the mixing chamber from more than one entrance port.

2. (Previously presented) The method of claim 1, further including:

expanding the combined stream downstream from the exit port.

3. (Original) The method of claim 1, further including:

introducing the second stream into a second stream manifold, and wherein directing the second stream includes directing the second stream from the second stream manifold via a plurality of second stream passages flow coupled to the mixing chamber.

4. (Original) The method of claim 1, wherein the first stream is directed into the mixing chamber at the first end of the mixing chamber.

5. (Previously presented) The method of claim 1, further including:

developing a substantially well-developed flow of the first stream within the plurality of first stream passages.

6. (Original) The method of claim 5, further including:

developing a substantially well-developed flow of the second stream within the at least one second stream passage.

7. (Canceled).

8. (Previously presented) The method of claim 1, further including:

sampling the combined stream for compliance with emission standards.

9. (Previously presented) An apparatus for mixing a first and a second stream of gas, comprising:

a first plurality of passages configured to direct the first stream of gas, wherein the first stream of gas is one of a stream of dilution air and a stream of exhaust gas from an engine; and

a mixing chamber having first and second ends, the mixing chamber being flow coupled to the first plurality of passages and configured to receive the second stream of gas at the first end, the mixing chamber having an exit port at the second end, the

second stream of gas is the other of the stream of dilution air and the stream of exhaust gas from an engine,

the method further including at least one of the following characteristic factors:

1) wherein the first plurality of passages and the second stream passage attach to the mixing chamber in a manner that the first and second streams of gas are unobstructed by structure as they enter the mixing chamber;

2) wherein the mixing chamber has an absence of structure extending into the mixing chamber;

3) wherein the first plurality of passages and the second stream passage are configured to introduce the first and second streams of gas into the mixing chamber with a substantially well-developed flow; and

4) wherein at least one of the first plurality of passages and the second stream passage is configured to introduce at least one of the first and second streams of gas, as an exhaust gas, into the mixing chamber from more than one entrance port.

10. (Original) The apparatus of claim 9, further including:

a secondary mixing region flow coupled to the mixing chamber downstream of the exit port, wherein the secondary mixing region has one of a cross-section that gradually increases as the distance from the exit port increases and a cross-section that abruptly increases.

11. (Previously presented) The apparatus of claim 10, further including:

a second stream passage flow coupled to the mixing chamber at the first end and adapted to discharge the second stream of gas into the mixing chamber,

wherein the plurality of passages, the second stream passage, the mixing chamber, and the secondary mixing region have smooth walls, and

wherein at least the second stream passage, the mixing chamber, and the secondary mixing region are insulated.

12. (Original) The apparatus of claim 9, further including:

a secondary mixing region flow coupled to the mixing chamber downstream of the exit port; and

a reservoir box flow coupled to the secondary mixing region at an end opposite the end which is flow coupled to the exit port.

13. (Original) The apparatus of claim 9, wherein the mixing chamber has internal wall surfaces formed of electro-polished, passivated, stainless steel.

14. (Original) The apparatus of claim 9, wherein the mixing chamber has smooth internal walls and no projections extending inwardly from the internal walls.

15. (Original) The apparatus of claim 9, further including:

a second stream manifold flow coupled to the second stream of gas; and

a second plurality of passages flow coupled to and extending between the second stream manifold and the mixing chamber,

wherein the first and second plurality of passages do not substantially extend into the mixing chamber.

16. (Previously presented) The apparatus of claim 15, wherein the second stream manifold is an annular chamber.

17. (Original) The apparatus of claim 9, wherein the first plurality of passages are flow coupled to the mixing chamber at the first end of the mixing chamber.

18. (Canceled).

19. (Canceled).

20. (Canceled).

21. (Canceled).

22. (Previously presented) A mixing chamber for mixing a first stream of gas with a second stream of gas, comprising:

an internal volume defined by a first end, a second end, and walls extending between the first and second ends, the second end having a gradually converging portion, with an absence of structure extending from the first end, from the second end, and from the walls into the internal volume;

a first inlet opening configured to receive the first stream of gas into the mixing chamber, the first inlet opening located at the first end;

a plurality of second inlet openings configured to receive the second stream of gas into the mixing chamber, the plurality of second inlet openings symmetrically positioned with respect to the first inlet opening; and

an exit opening configured to discharge a combined stream of gas formed from the first and second streams of gas from the mixing chamber, the exit opening located downstream of the gradually converging portion wherein the first inlet opening and the plurality of second inlet openings are situated in a manner that the first and second streams of gas are unobstructed by structure extending into the mixing chamber.

23. (Original) The mixing chamber of claim 22, wherein the first stream of gas is a stream of exhaust gas from an engine and the second stream of gas is a stream of dilution air.

24. (Original) The mixing chamber of claim 22, wherein the first end, the second end, and the walls have internal surfaces formed of electro-polished, passivated, stainless steel.

25. (Previously presented) The mixing chamber of claim 22, wherein the first inlet opening and the plurality of second inlet openings are situated in a manner that the first and second streams of gas avoid impinging on each other as they enter the mixing chamber.

26. (Previously presented) The method of claim 1, wherein the characteristic factor of directing the first and second streams of gas through the plurality of first stream passages and the second stream passage into the mixing chamber in a manner that the streams of gas are unobstructed by structure as they enter the mixing chamber includes

directing the first and second streams of gas in a manner that they avoid impinging on each other as they enter the mixing chamber.

27. (Previously presented) The apparatus of claim 9, wherein the characteristic factor of the first plurality of passages and the second stream passage attach to the mixing chamber in a manner that the first and second streams of gas are unobstructed by structure as they enter the mixing chamber includes

the first plurality of passages and the second stream passage being configured in a manner that the first and second streams of gas avoid impinging on each other as they enter the mixing chamber.

28. (Previously presented) The method of claim 1, including more than one of the characteristic factors.

29. (Previously presented) The apparatus of claim 9, including more than one of the characteristic factors.

30. (Previously presented) A method of mixing a first stream of gas with a second stream of gas, comprising:

introducing a first stream of gas into a mixing chamber via a plurality of first stream passages flow coupled to the mixing chamber;

directing a second stream of gas into the mixing chamber via at least one second stream passage flow coupled to a first end of the mixing chamber;

forming a combined stream from the first and second streams;

discharging the combined stream from the mixing chamber through a mixing chamber exit port;

providing walls of the mixing chamber with an absence of structure extending into the chamber; and

introducing at least one of the first and second streams of gas into the mixing chamber as an entire exhaust gas flow.

31. (Previously presented) An apparatus for mixing a first and a second stream of gas, comprising:

a first plurality of passages configured to direct the first stream of gas;

a second stream passage configured to receive the second stream of gas;

a mixing chamber having first and second ends, the mixing chamber being flow coupled to the first plurality of passages and being flow coupled to the second stream passage, the mixing chamber having an exit port at the second end,

the mixing chamber having an absence of structure extending into the chamber; and

wherein at least one of the first plurality of passages and the second stream passage is configured to introduce at least one of the first and second streams of gas into the mixing chamber as an entire exhaust gas flow.

32. (Previously presented) A method of mixing an exhaust gas with a dilution gas for an emissions sampling system, comprising:

directing the flow of an exhaust gas from an engine through an exhaust gas passage;

directing the flow of a dilution gas through a dilution gas passage;

receiving the dilution gas from the dilution gas passage at one end of a mixing chamber, the mixing chamber being flow coupled to the dilution gas passage;

receiving the exhaust gas into the mixing chamber from the exhaust gas passage;

developing a substantially well-developed flow stream of the dilution gas upstream of the exhaust gas passage;

sampling the combined stream for compliance with emission standards; and

discharging a combined stream of the exhaust gas and the dilution gas from the mixing chamber.

33. (Previously presented) The method of claim 32, wherein the mixing chamber includes an absence of structure extending into the mixing chamber.

34. (Previously presented) An emissions sampling system for mixing an exhaust gas with a dilution gas, comprising:

an exhaust gas passage configured to direct a flow of the exhaust gas from an engine;

a dilution gas passage configured to direct a flow of the dilution gas;

a mixing chamber flow coupled to the dilution gas passage and configured to receive the dilution gas from the dilution gas passage at one end, the mixing chamber also being configured to receive the exhaust gas from the exhaust gas passage; and

a sampling device in the mixing chamber to sample the gas in the mixing chamber,

wherein the dilution gas passage is configured to create a substantially well-developed flow stream of the dilution gas upstream of the exhaust gas passage,

wherein the mixing chamber includes an end configured to discharge a combined stream of the exhaust gas and the dilution gas from the mixing chamber.

35. (Previously presented) The emissions sampling system of claim 34, wherein the mixing chamber includes an absence of structure extending into the mixing chamber.